Fuels & Fire Analysis
Last Chance Fuels Reduction Project
Placerville Ranger District

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Existing Condition/ Area Description:

- The Middle Fork of the Consumnes River lies to the South of the project area. This river canyon can exert a strong effect on fire behavior. Because the canyon is aligned with the prevailing Southwest winds they are funneled through the canyon with unimpeded speeds of 10 to 15 mph (Fire weather Hand book, conversation w/Smith). Furthermore bends in the canyon cause erratic wind conditions, as observed in the Cleveland fire.

- GIS Fire History Layers show 12 Class C or larger fires between 1914 and 1996, with an average size of 113 acres, within 1 ½ miles of the project area. Between 1960 and 1992 there have been 55 Class A and B fires.

- Analysis shows that in one-third of the project area fires can develop flame lengths greater than 6 ft.

- Stand conditions vary through out the project area. Along ridgetops manzanita and bear clover are ubiquitous, either occurring in patches or as a decadent part of the under story. Most of the stands have an over-abundance of conifer regeneration. A 3-foot crown base height is the norm.

- The project area abuts the community of Grizzly Flat, identified as a community at risk under the National Fire Plan.

Effects to Fuels

Fuel models were first determined using the forest GIS fuel model layer. Models were adapted after sight visits.

Surface fuels are all material lying on, or immediately above, the ground, including needles or leaves, duff, grass, small dead wood, downed logs, and large limbs. Fire is able to carry from surface fuels through convection into the crowns with relative ease. Ladder fuels are fuels that provide vertical continuity between the ground and the tree canopy. Ladder fuels are present as shrubs, mainly manzanita and conifer regeneration. All fuels affect flame length, which in turn affects scorch, torching, and mortality.

Canopy bulk density, a measure of available canopy fuels (all needles and 50% of the < 0.25” diameter material), combined with continuous crown closure is needed for sustained crown fire. Single or multiple tree torching can occur whenever surface fire intensity (flame length) generates flames that can carry into the crowns.

No Action

Direct Effects

There are no known direct effects to fuels or change to surface loading in the short term by taking no action.

Indirect Effects

Over time, in the absence of prescribed fire or any treatment that would reduce ladder or surface fuels, fuel loading would continue to increase. Debris is added to the forest floor annually.

As a stand becomes more dense, shrubs such as bearclover and manzanita could become less vigorous and eventually die out under increasing shade. The stand density index indicates that as the number of trees increases within a stand, shade intolerant species would die out. As this takes place surface fuel loading would increase. The shade tolerant species, white fir and incense cedar, are less fire resistant than the shade intolerant pines. This would cause an increase in the probability of mortality for the stand when a wild fire occurs. These stands would also experience greater mortality under less severe fire conditions.

In the event of a wildfire occurring under current conditions in the project area, initial attack costs would be similar to those shown in the following table. These National Fire Management Analysis System (NFMAS) costs are based on 20-year average for the Eldorado National Forest

Size of Wildfire (Acres)	Cost per Acre
0-0.25	$9,297
0.26-10	$5,709
11-100	$2,178
101-300	$1,777
301-1000	$1,284
1001 +	$ 601

Cumulative Effects

Fuels reduction has occurred on forest land. Fuels reduction work has occurred in connection with the Ridgerunner, Nelly, Lincoln Log and Tie Die Timber Sales, thinning ridge top stands, piling and burning brush, and using prescribed fire to reduce fuels in the harvest units. Additionally prescribed fire has been used to reduce fuels in the Caldor Burn Project. Further burning is planned in the Lincoln Log and Ridgerunner project Areas. The California Department of Forestry and Fire Protection (CDF), in conjunction with the El Dorado County Fire Safe Council, is planning fuels reduction on private land using grant money available through the National Fire Plan.

Currently these areas are in disconnected patches and do not provide strategic landscape-wide fuel treatment. The project area and the community of Grizzly Flat will continue to be at high risk to wildfire damage from fire spreading into the area. Further the

probability of CDF's proposed treatments being funded are lessened without the accompanying federal project.

Proposed Action

Changes in Threat and Defense Zones

Appendix A (pg A 10) of the ROD for the Sierra Nevada Forest Plan Amendment states: "Fuel reduction treatments are designed to protect human communities from wildland fires as well as minimize the spread of fires that originate in urban areas. The management objective in the urban wildland intermix zone is to enhance fire suppression capabilities by modifying fire behavior inside the zone and providing a safe and effective area for possible future fire suppression activities."

The existing threat and defense zones were based on the actual location of structures meeting the appropriate density standards. The Sierra Nevada Forest Plan Amendment also states that: "The actual boundaries of the urban wildland intermix zones are determined locally, based on the actual distribution of structures and communities adjacent or intermixed with national forest lands Strategic landscape features, such as, roads, changes in fuel types, and topography, are used in delineating the physical boundary of the urban wildland intermix zone."

Fire behavior in The Middle and North Fork of the Consumnes River Canyon and its immediate tributaries can be quite intense and erratic; there have been 12 C class fires on record in, or adjacent to, the project area. Unimpeded winds in canyons can range from 10 to15 mph. Turns in the canyon can cause these winds to be erratic. Observed fire behavior (Cleveland fire) shows that fires in canyons jump from one side to the other. This makes small isolated defense zones ineffective.

Analysis shows that in one-third of the project area fires can develop flame lengths greater than 6 ft. Analysis also shows that 65% of the area has a crown fire potential under moderate weather conditions.

Many of the current defense zones in the Last Chance project area are small mid-slope areas. These would be ineffective in the strategic suppression of a wildland fire. Access is limited and topography would make control unlikely and unsafe.

On the Last Chance Project it was decided to change the designation of units, or portions of units, which have ground suitable for mechanical fuels treatment, from threat to defense designation. These units fall within SPLATS and changes in Defense Zones identified in the landscape analysis of the North Fork of the Consumnes. These changes were based on topography, access, and fire behavior. This allows the project to tie in with existing work already completed by Eldorado National Forest.

By expanding the Defense zones to the major ridge tops they will become more effective in controlling the spread of a major fire coming out of the canyon. These ridges are roaded with easy access for equipment and personnel. Line production rates would be faster on ridges than on slopes, and application of aerial retardant would be safer and

more effective. The same fuel modifications that would have been applied mid-slope when applied to a ridge are more effective as the effect of slope on spread of fire is removed.

Mechanically Treated Areas

Omi and Martinson (2002) state that Crown bulk density is significantly correlated to crown volume scorched and height to live crown has the strongest correlation to fire severity. This action proposes to mechanically thin understory and canopy trees to raise the live crown base height to 15 to 20 feet, masticate and/or cut and pile shrubs, and underburn. This alternative would treat the ladder and surface fuels, reduce canopy bulk density, raise canopy base height, and result in reduced fire behavior and potential for crown fire in the event of a wildfire.

Direct Effects

Mechanical treatments would reduce the size of 3” diameter and larger surface fuels. Mechanized treatment will also change the arrangement of fuels by crushing shrubs and small trees, further reducing ladder fuels that can cause scorch and torching in prescribed burns and wildfire. Mastication of brush fields would reduce fuel bed bulk depth, thereby reducing flame height, from 6 down to 2 feet; the fire behavior would be similar to a light slash model. Thinning would remove ladder fuels resulting in a change in fire behavior, from a crown fire to a surface fire.

Modeling predicts that a prescribed backing fire using a hot prescription would cause nearly 80% mortality in the residual <10”diameter trees after mechanized treatment (Ref. FOFEM mortality tables). Mortality from prescribed fire in the >10” diameter trees would be less than 10%. This should not significantly increase surface fuel loading as the trees decay and fall to the ground. This is because stand density in the smaller diameter trees has been greatly reduced through the proposed mechanical treatments.

Indirect Effects

Reductions in fuel loading and stand density, changes in species composition, and raising of the canopy base height would produce changes in the behavior and effects of wild fire. The mortality in trees 10” and greater in diameter would be reduced due to changes in species composition and the raising of the crown base height. Species remaining would tend to be the more fire resistant dominant pines and Douglas firs. The reduction in fuel loading and raising of the crown base height would reduce torching and the probability that a fire would move into the crowns.

These effects were demonstrated during the Cone fire on the Shasta National Forest in 2002. This severe wildfire burned into plots on the Black Mountain Experimental Forest. When the fire reached thinned and unburned plots it transitioned from a crown fire to a surface fire. Where the thinned units had been burned the fire could not burn through and stopped at the edge of the treatment. The burn treatments were 2 to 5 years old. (Skinner, personal communication 2003)

Cumulative Effects

Fuels reduction work has occurred in connection with the Ridgerunner, Nelly, Lincoln Log and Tie Die Timber Sales, thinning ridge top stands, piling and burning brush, and using prescribed fire to reduce surface fuels in the harvest units. Additionally prescribed fire has been used to reduce fuels in the Caldor Burn Project. The California Department of Forestry and Fire Protection (CDF) in conjunction with the El Dorado County Fire Safe Council are planning fuels reduction on private lands using grant money available through the National Fire Plan.

This project would connect these areas and produce a more strategic landscape-wide fuel treatment. The project area and the community of Grizzly Flat will continue to be at high risk to wildfire damage from fire spreading into the area. Further the probability of the CDF's proposed treatments being funded are lessened without the accompanying federal project.

Moderate fire weather conditions on the Eldorado National Forest (90th percentile weather parameters
NFDRS station= Bald Mountain with 25 mph 20 ft. wind speed)

1 hour fuel moisture	10 hour fuel moisture	100 hour fuel moisture	1000 hour fuel moisture	20 ft wind speed	Live fuel moisture
5%	6%	8%	10%	25	70

Comparison of predicted stand conditions and fire behavior in the event of a wildfire after treatment (Wildfire @ 90th percentile weather)

Stand Conditions	No Action	Proposed Action Mechanical Thin	Proposed Action Mastication	Proposed Action Prescribed Fire
Canopy Cover %	20-70	20-70	20-70	50-70
Height to Live Crown, ft.	2-6	10-25	15-25	10
Flame length, ft*	1-18	1-4	1-4	1-3
Rate of spread, ch/hr	1-59	0-8	0-8	0-6
Fire type	Active or Passive Crown	Surface	Surface	Surface
Fireline production	6-15 Ch/hr	7-28 Ch/hr	7-28 Ch/hr	7-28 Ch/hr
Mortality <10" trees	95-100%	66-78%	66-78%	66-78%
Mortality >10" trees	40-100%	40%	40%	40%

* Flame lengths are for the surface fuels only the do not reflect Crown flame lengths.

Proposed Action - Prescribed Fire Only Areas

Direct Effects

Underburning alone in the units within the Threat Zone would reduce 0 to 3-inch surface fuel loading, burn bearclover, top-kill brush, and kill small conifers and hardwoods temporarily reducing fire behavior. Some preparatory hand treatment of trees less than 6" dbh may be required to reduce the ladder fuels prior to the implementation of the burn.

Mortality rates based on tables developed using FOFEM predict that a prescribed backing fire using a hot prescription would cause up to 68% mortality in the <10" diameter oaks and 70% mortality in conifers, thereby increasing the height to live crown base. Mortality for oaks greater than 10" diameter and less than 20" is predicted to be up to 40%, for conifers in this size range mortality could be as high as 15%. Oaks between 20" and less than 30" dbh would have mortality rates of 13 to 24%. For conifers in this size range mortality could is predicted to be 6%. While oaks 30" dbh and greater would have mortality rates of 13% or less and no mortality was predicted in conifers. Historically mortality rates have been observed to be much lower in oaks and conifers between 10" and 30" dbh on prescribed fires conducted on the Eldorado; generally oaks with a dbh of 6 inches and greater are fairly fire tolerant. Burning under cooler or moister fuel moisture conditions could reduce the amount of mortality in all sizes of trees, but may not reduce surface fuels nor create a sufficient crown base height to withstand additional mortality from a wildfire.

Prescribed fire weather conditions – example of a "Hot" burning prescription

1 hour fuel moisture	10 hour fuel moisture	100 hour fuel moisture	1000 hour fuel moisture	20ft wind speed mph	Mid flame wind mph	Live fuel moisture
5%	6%	8%	18%	10	3	100

Prescribed fire behavior – example of a backing fire

FBPS Fuel Model	Rate of Spread (ch/hr)	Heat per Unit Area (Btu/ft2)	Fireline Intensity (Btu/ft/sec)	Flame Length (ft)	Mid flame wind (mph)	Scorch Height (ft)
11	0.4	779	5	1.0	3	1
35	0.6	1473	17	1.6	3	4

Indirect Effects

Shrub species and hardwoods will re-sprout within one growing season but would have a lesser flame length for 5 to 10 years until plants reach full size and produce a significant amount of dead branches.

In the event of a wildfire 5-10 years after prescribed fire treatment, mortality is likely in larger (>10" diameter) trees. In this period of time surface fuel loading would recover to near current conditions due to the accumulation of dead material created from the single prescribed burn. Fire behavior and tree mortality could be similar to that before treatment.

Cumulative Effects

On the High Meadow site, a ponderosa pine dominated site in the southern Rocky Mountains of Colorado, Omi and Martinson (2002) found that in one of the wildfires sampled included areas where the only recent treatment was a single prescribed fire. They found fire severity reductions in that treated area that could not be correlated to differences in stand conditions. They also suggest from the results of the Cerro Grande fire that under extremely windy conditions it may be surface fuels that are of little importance.

A single prescribed fire, by itself, does the least in reducing canopy base height and crown bulk density. Under more moderate weather conditions this treatment would reduce severity short term, 5-10 years, in these stands. In the long term, more than 10 years, these single treatments would have little effect, as ground fuels accumulate and fuel ladders are reestablished.

Direct Effects of All Treatments to Fire Behavior and Suppression Capabilities

Fireline intensity, as measured by flame length, directly affects suppression tactics and capabilities. Fires with less than 4-foot flame lengths can be attacked directly with hand or engine crews. As intensity increases, changes in tactics and equipment are needed to slow or stop the spread of fire.

Fireline production is based on rates from Appendix A-20, Fireline Handbook, Jan. 1998, for initial attack line construction by a Type 1 20-person hand crew in Fuel Model 8, 9 and 10. Surface fuel loading and ladder fuels have a direct effect on amount of fireline that can be constructed in a given time and the rate of construction can vary.

Wind has a direct effect on fire behavior. Wind is also affected by vegetation and terrain and varies within an area for any given fire. Midflame wind speed is a function of 20 foot winds multiplied by a wind reduction factor. The reduction factor is calculated based on sheltering effect of the fuels from overstory and can change with landscape position. The Proposed Action removes vegetation to create a more open space between the ground and crown base. Modeling illustrates a slight increase in mid flame wind speed, but this does not significantly change flame lengths or rates of spread which affect suppression tactics.